भारतीय मानक
Indian Standard

IS 10109 : 2018

तेल दाबस्टोव — अन्तर्लम्ब बर्नर टाइप — विशिष्टि

(दूसरा पुनरीक्षण)

Oil Pressure Stoves — Offset Burner Type — Specification

(Second Revision)

ICS 75.160.20; 97.040.20

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Oil Burning Appliances Sectional Committee, MED 26

FOREWORD

This Indian Standard (Second Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Oil Burning Appliances Sectional Committee had been approved by the Mechanical Engineering Divisional Council.

This standard was first published in 1981 and subsequently revised in 2002. This standard is being revised to incorporate the amendments issued and the suggestions received from time-to-time for improvement.

The offset burner type pressure stoves have become very popular with the consumers. The stoves of this type are safer as the fuel tank is not directly attached to the burner.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2:1960 ‘Rules for rounding off numerical values (*revised*)’. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

OIL PRESSURE STOVES — OFFSET BURNER TYPE — SPECIFICATION

(Second Revision)

1 SCOPE

This standard covers the requirements and tests for offset burner type oil pressure stoves, intended for domestic and commercial use, burning pressurized kerosene oil under a normal working pressure of 100 kN/m^2 to 200 kN/m^2 (1 kgf/cm^2 to 2 kgf/cm^2)

2 REFERENCE

The standards given in Annex A contain provisions, which through reference in this text, constitute provisions to this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards listed in Annex A.

3 TERMINOLOGY

For the purpose of this standard, the nomenclature of the different parts of the stove shall be as indicated in Fig. 1.

4 CAPACITY

The stoves shall be made in 1.5 to 10 litres nominal capacities in steps of 0.5 litre capacities and shall be measured by filling oil to the maximum through the oil-filler cap which shall hold not more than 94 percent of the capacity of the tank.

5 MATERIAL

5.1 Material used in the manufacture of different parts shall be such that they would ensure safe handling and good performance of the stove throughout its reasonable life.

5.2 Fuel Container — The fuel container shall be made either from seamless steel pipe or from pipe welded from one piece steel sheet (*see* IS 513 or IS 1079). One Piece dished plates shall be welded to the pipe at two ends. Alternatively fuel container shall be either pressed or spun. After fabrication, minimum specified thickness shall be maintained and shall be stress relieved. It shall withstand the pressure requirements and conforms to other tests as laid down in **9.1.1**, **9.1.2**, **9.1.3** and **9.3**

5.2.1 The welding shall be sound and shall fully penetrate.

5.3 Typical materials that are commonly used in the manufacturing of other components are given in Annex B.

5.4 Plastic components (for example, handles) shall be free from fissures, distortions, blemishes and discolouration.

5.5 Materials for burners for oil pressure stoves shall be as given in IS 8808.

6 SHAPE AND DIMENSIONS

6.1 Common shape of an offset type burner shown in Fig. 1. It may be made in single-burner (as shown in Fig.1) or double burner design.

6.2 The stove shall be made in sizes according to its capacity given at **4**. The overall dimensions of fuel tank, the frame and stove shall be as agreed to between the purchaser and the supplier. However, the stoves so manufactured should satisfy all the performance requirements. Also the vessel when kept on the stove shall not touch burner top.

6.3 Burners for stoves up to 3.5 litres capacity shall satisfy all the requirements of IS 8808. However, burners for stoves of more than 3.5 litres capacity shall satisfy test requirements of IS 8808. The flame ring shall conform to Fig. 2.

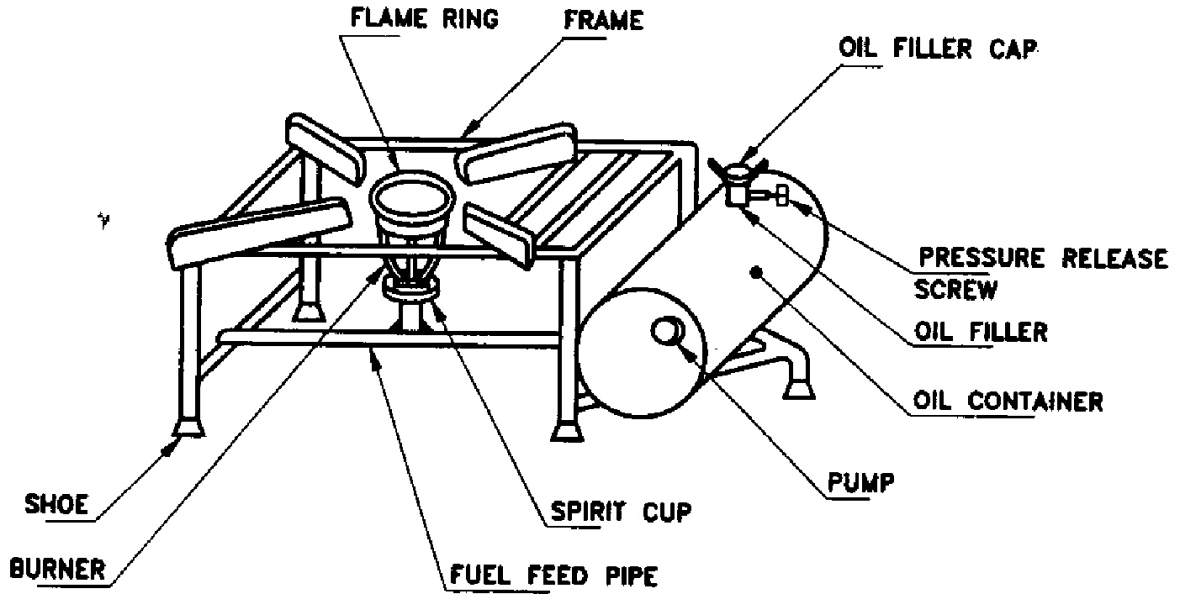
6.4 The minimum sheet thickness of the fuel container up to and including the capacity of 3.5 litres shall be 1.0 mm and for capacity above 3.5 litres shall be 1.6 mm when measured at any point.

6.5 To ensure maximum utilization of the fuel in the tank to the maximum possible extent, the maximum height of the fuel feed pipe into the oil container from its bottom may be 10 mm up to and including 3.5 litres capacity and 15mm for more than 3.5 litres capacity.

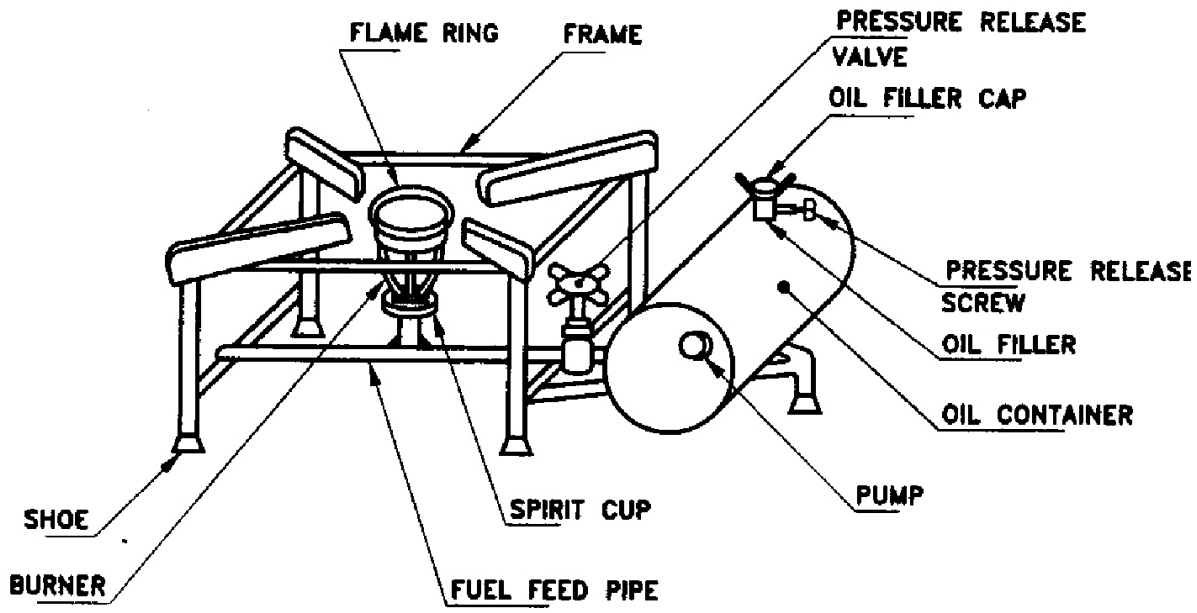
7 CONSTRUCTION

7.1 General

7.1.1 The frame of the stove shall be so made as to be firm on its base. The base of the fuel container shall be at least 15 mm clear from the ground. The fuel container may be of detachable type.

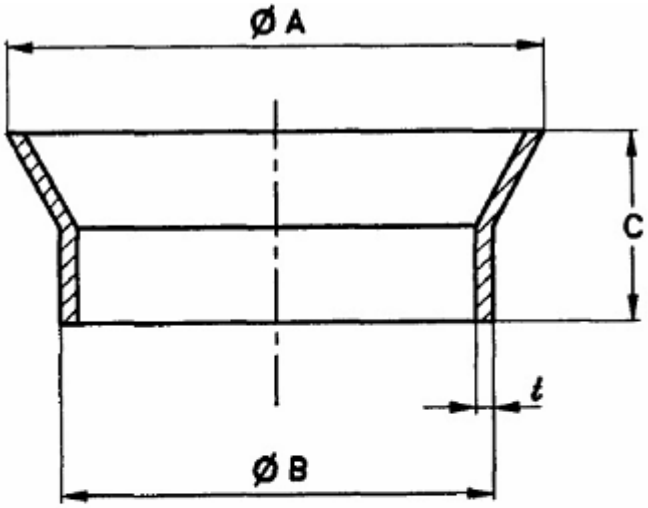


FIXED TYPE OIL CONTAINER



DETACHABLE TYPE OIL CONTAINER

FIG. 1 OIL PRESSURE STOVE, OFFSET BURNER TYPE, TYPICAL



Stove Capacity Litres	Ø *A* mm ± 0.5	Ø *B* mm ± 0.5	*C* mm ± 0.5	Sheet Thickness at Any Point (*t*) mm, *Min*
Up to 1.2	52	41	20	0.6
1.3 to 2.2	67	50	22	0.7
2.3 to 3.5	86	68	30	1.0

NOTE — Dimensions *A*, *B* and *C* are optional.

FIG. 2 FLAME RING

7.1.2 Stove, both when full of fuel and when empty, shall be capable of being tilted in any direction to an angle of 15° from the vertical, without overturning at that inclination or on being released.

7.1.3 Regulator near the socket of the burner may be provided for opening and closing of the fuel supply. In case the regulator is not provided, the kerosene oil should not come out of nipple when the tank is full under atmospheric pressure.

7.2 Burner Assembly — Construction of all types of burner, for oil pressure stoves shall be as given in IS 8808.

7.3 Pump — The pump shall be of sound construction and shall be capable of developing and retaining a pressure of 250 kN/m^2 (2.5 kgf/cm^2). The pump washer and non-return valve shall be removable.

7.4 Pressure Release Screw — The fuel container shall be fitted with a pressure release screw for releasing the container pressure quickly and safely.

7.5 Oil Filler Cap Assembly — The filler cap assembly shall be leak-proof at an air pressure of 250 kN/m^2 (2.5 kgf/cm^2) (*see also* **9.1.1**). The oil filler cap assembly shall be so fitted that the oil container shall be able to retain oil up to the capacity of 94 percent of its full capacity.

7.6 Washers

7.6.1 The washer for oil filler cap shall be made from Acrylonitrile-Butadiene Rubber (NBR) or other equally suitable material, which is resistant to heat and kerosene oil. It shall not become tacky or swollen when kept immersed in kerosene oil at 60°C for 24 h continuously (in three durations of 8 h each).

7.6.2 The pump washer shall be made from curried buffalo leather or other equally suitable material and shall be treated to avoid hardening and cracking.

7.7 Taps

In case of double burner design, the appliance shall have one tap for each burner. The 'ON' and 'OFF' shall be clearly and durably indicated on the taps.

7.8 Strength of Body of Stove — The top plate of the stove or vessel supports, whichever the case may be, shall be so designed so as to be adequately strong to withstand the minimum load calculated in accordance with the following:

a) *For circular top plate* — Diameter in cm of top plate expressed in kg and

b) *For square frame* — Side of the square in cm expressed in kg.

Load as mentioned in (a) and (b) may be applied by standard vessel plus water. Standard vessel shall be selected from Table 1.

7.8.1 The load as calculated above shall be applied uniformly distributed for a period of one hour. At the end of the test, there shall not be any deformation or permanent set of any component of the stove.

7.9 Interchangeable Parts

7.9.1 The following parts shall be interchangeable in the same type of stove:

a) Burner;
b) Nipple;
c) Flame ring;
d) Spirit cup;
e) Oil filler cap;
f) Pressure-release screw;
g) Oil cap plug;
h) Pump valve;
j] Pump washer; and
k) Pump cap.

7.10 Pricker — The pricker shall have a steel wire of diameter 0.05 mm less than the diameter of the nipple hole and shall be fixed in a steel/tin plate strip**.**

8 WORKMANSHIP AND FINISH

8.1 The surface shall show no defects when visually examined for pinholes, blisters, roughness and exposed areas of metal, which might give rise to rapid deterioration in the use.

8.2 All steel parts shall be painted by heat-resistance paint. The painted surface shall not chip or flake during use. The pump rod and nut when made of mild steel shall be tin plated (*see* IS 1359) or zinc plated (*see* IS 1573) or powder coating (*see* IS 13871) as desired by the purchaser.

8.3 Vitreous enamelled parts shall comply with the requirements of relevant part of IS 3972.

8.4 Nickel and chromium plating of parts shall be according to IS 1068.

9 TESTS

9.1 Pressure Test

9.1.1 *Air Pressure Test*

Each fuel container fitted with pump valve, burner and oil cap, shall withstand an internal air pressure of 250 kN/m^2 (2.5 kgf/cm^2) and shall not show any sign of leakage or deformation.

9.1.2 *Safety Pressure Test*

The container, without burner and pump valve shall be subjected to an internal hydraulic pressure of 600 kN/m^2 (6 kgf/cm^2) for a period of 5 minutes. The container shall not show any sign of leakage or any appreciable deformation.

9.1.3 *Bursting Pressure Test*

When the container selected in **9.1.2** is further subjected to a hydraulic pressure of 1 000 kN/m^2 (10 kgf/cm^2), it shall neither burst nor unduly distort. Slight leakage of the hydraulic fluid shall be permissible, provided the pressure is capable of being maintained for duration of not less than 5 minutes.

9.2 Fuel Consumption

Each stove shall give within ±15 percent of the manufacturer's specified fuel consumption in g/h when tested in accordance with Annex C.

9.3 Thermal Efficiency — When tested in accordance with the method described in Annex C the thermal efficiency of the stove shall be not less than:

a) 55 percent for stove with roarer type burner, and
b) 58 percent for stove with silencer type burner.

9.3.1 Thermal efficiency may be declared, if it is more than 60 percent and above for stove of roarer type burner and 62 percent and above for stove of silencer type burner.

9.4 Surface Temperature and Fuel Temperature of the Surface — Temperature of any part of the stove that may be necessary to touch during its operation as well as the maximum fuel temperature attained during three hours continuous operation of the stove shall not exceed 60°C, when measured in accordance with method prescribed in Annex D.

9.5 Combustion Efficiency — When tested in accordance with the details laid down in Annex E, the carbon monoxide/carbon dioxide ratio of exhaust gases of each burner, while burning with maximum blue flame, shall not exceed 0.02.

9.6 Resistance to Draught — There shall be no extinction of the flame on the burner while operating at a pressure of 140 kN/m^2 (1.4 kgf/cm^2) when the appliance is placed in a normal (not localized) current of air with a velocity of 2 m/s, as measured with a rotating vane anemometer. The location of the appliance relative to neighbouring walls and the direction of the draught shall be varied to correspond to likely conditions of appliance installation.

9.7 Fuel Creep — When operated under normal conditions with the fuel container filled to its three-

fourths capacity, there shall be no spreading of fuel over any part of the appliance so as to cause undesirable odour or any increase in flame size.

10 Sampling — Sampling and acceptance criteria for oil pressure stoves shall be as agreed to between the purchaser and the supplier. A recommended scheme for the same is given in Annex F.

11 INSTRUCTIONS

Instruction for the safe use of the stove shall be supplied with the stove in Hindi, English and other regional language. These shall include the following:

a) Prior to lighting the stove, ensure that all the components are undamaged and properly assembled in accordance with the design;
b) Fill kerosene oil in the container (through a funnel with filter) not exceeding three-fourths capacity of the container. Do not use fuel other than kerosene oil.
c) Heat burner of the stove, adequately by spirit or kerosene-soaked external heater and then pump the air moderately to obtain a uniformly spread blue and stable flame;
d) Clean the clogged burner regularly to get the required flame;
e) Reduce the flame, just enough to keep the contents boiling, once the boiling conditions have reached;
f) Maximum oil consumption rate in g/h;
g) Expected thermal efficiency; and
h) Total oil filling capacity in litres.

12 MARKING

12.1 Each stove shall be marked with the manufacturer's name, initial or his registered trade-mark and the capacity of fuel container. The stove shall also be marked with the following:

'Fuel consumption rate in g/h with a tolerance of ±15 percent (stickers may be used)'.

12.2 BIS Certification Marking

12.2.1 Each product may also be marked with the Standard Mark.

12.2.1.1 The use of the Standard Mark is governed by the provisions of *the Bureau of Indian Standards Act, 1986* and the Rules and Regulation made there under. The details of conditions under which the Licence for the use of the Standard Mark may be granted to manufacturers or producers may be obtained from the Bureau of 1ndian Standards.

13 PACKING

13.1 Each stove shall be packed in cardboard box together with the instruction sheet and the following accessories:

a) Prickers (three);
b) Pump washer (one);
c) Filler cap washer (one);
d) Burner washer (one);
e) Funnel with filter (one);
f) Spanner for burner (one);
g) Flame ring (one);
h) Spanner for nipple (one); and
j) Nipples (two).

} If required by the purchaser

ANNEX A

(*Clause* **2**)

LIST OF REFERRED INDIAN STANDARDS

IS No.	*Title*
210 : 2009	Grey iron castings — Specification (*fifth revision*)
280 : 2006	Mild steel wire for general engineering purposes (*fourth revision*)
319 : 2007	Free cutting brass bars, rods and section — Specification (*fifth revision*)
513 : 2008	Cold reduced low carbon steel sheet and strip (*fifth revision*)
1068 : 1993	Electroplated coatings of nickel plus chromium and copper plus nickel plus chromium — Specification (*third revision*)
1079 : 2009	Hot rolled carbon steel sheet and strip — Specification (*sixth revision*)

IS No.	*Title*
1239 (Part 1) : 2004	Steel tubes, tubulars and other wrought steel fittings-Specification: Part 1 Steel tubes (*sixth revision*)
1359 : 1992	Electroplated coatings of tin-Specification (*third revision*)
1459 : 2016	Specification for kerosene (*second revision*)
1573 : 1986	Specification for electroplated coatings of zinc on iron and steel (*second revis*ion)
2039 (Part 1 to 3) : 1991	Steel tubes for bicycle and cycle rickshaws — Specification (*second revision*)
2062 : 2011	Hot rolled medium and high tensile structural steel — Specification (*seventh revision*)
3972 (Part 1/Sec 1) : 1982	Methods of Test For Vitreous Enamelware: Part 1 Production Of Specimens For Testing, Section 1 Enamelled Sheet Steel (*first revision*)
3972 (Part 1/Sec 2) : 1982	Methods of Test for Vitreous Enamelware Part 1 : Production of Specimen for Testing — Section 2 : Enamelled Cast Iron (*first revision)*
(Part 2/Sec 1) : 1985	Part 2 : Test Methods — Section 1: Resistance to Citric Acid at Room Temperature and Boiling Temperature (*first revision)*
(Part 2/Sec 2) : 1985	Part 2 Test methods, Section 2: Low and high voltage tests for detecting and locating defects (*first revision)*
(Part 2/Sec 3) : 1988	Part 2 Test methods, Section 3: Resistance to boiling water and water vapour (*first revision*)
(Part 2/Sec 4) : 1988	Part 2 Test methods, Section 4: Resistance to thermal shock (*first revision*)
(Part 2/Sec 5) : 1988	Part 2 Test methods, Section 5 Resistance to hot alkali (sodium hydroxide) (*first revision*)
(Part 2/Sec 6) : 1988	Part 2 Test methods, Section 6: Reflectance and specular gloss (*first revision*)
3972 (Part 2/Sec 7) : 1997	Part 2 Test methods — Section 7: Resistance to boiling hydrochloric acid (*first revision*)
3972 (Part 2/Sec 8) : 1990	Part 2 Test methods — Section 8: Resistance to heat (*first revision*)
3972 (Part 2/Sec 9) : 1991	Part 2 Test methods — Section 9: Resistance to dilute sulphuric acid (*first revision*)
3972 (Part 2/Sec 11) : 1995	Part 2 Test methods — Section 11 Resistance to abrasion (*first revision*)
3972(Part 2/Sec 12): 1999	Part 2 Test methods — Section 12: Resistance to torsion (*first revision*)
3972(Part 2/Sec 13): 2007	Part 2 Test methods — Section 13: Resistance to warpage (*first revision*)
3972(Part 2/Sec 14): 2007	Part 2 Test methods — Section 14: Resistance to adherence (*first revision*)
4905 : 2015	Methods for random sampling
6527 : 1995	Stainless steel wire rods — Specification (*first revision*)
6913 : 1973	Specification for stainless steel tubes for the food and beverage industry
8808 : 1999	Burners for oil pressure stoves and oil pressure heaters — Specification (*second revision*)
13871 : 1993	Powder coatings — Specification

ANNEX B

(*Clause* **5.3**)

MATERIALS COMMONLY USED IN THE MANUFACTURE OF COMPONENTS OF OIL PRESSURE STOVES, OTHER THAN THOSE SPECIFIED IN 5.2

Sl No.	*Component*	*Material*	*Recommended Specification*
(1)	(2)	(3)	(4)
1)	Fuel feed pipe	ERW mild steel tube minimum thickness, 1.0 mm	IS 1239 (Part 1)
2)	Frame	Grey cast iron or Mild steel wire or Steel tube	IS 280 IS 280 IS 2039 (Part 1 to 3)
3)	Pump tube	Mild steel tube or Stainless steel tube	IS 1239 (Part 1) IS 6913
4)	Pump valve body	Brass rod	IS 319
5)	Pump rod, nut and washer	Brass rod or Mild steel rod or Stainless steel rod	IS 319 IS 2062 IS 6527
6)	Pump valve screw	Brass rod or Steel tube or Mild steel wire	IS 319 IS 2039 (Part 1 to 3) IS 280
7)	Pump cap	Mild steel rod	IS 2062
8)	Pump piston	Steel tube or Brass rod	IS 2039 (Part 1 to 3) IS 319
9)	Spirit cup	CRCA sheet	IS 513
10)	Burner socket	Mild steel rod	IS 2062

ANNEX C

(*Clauses* **9.2** and **9.3**)

TEST FOR THERMAL EFFICIENCY

C-1 THERMAL EFFICIENCY

C-1.1 Thermal efficiency of a stove may be defined as the ratio of heat actually utilized to the heat theoretically produced by complete combustion of a given quantity of fuel (which is based on the net calorific value of the fuel).

C-2 CONDITIONS FOR CARRYING OUT THERMAL EFFICIENCY TEST

C-2.1 Test Room Conditions

C-2.1.1 The air of the test room shall be free from draught likely to affect the performance of the stove. The room temperature shall be maintained at 25°C to 30°C.

C-2.1.2 At the start of the test, the stove and the kerosene in its container shall be at room temperature.

C-2.2 Test Kerosene

C-2.2.1 The kerosene to be used in conducting the test shall conform to IS 1459.

C-2.3 Setting of the Stove

C-2.3.1 The stove whose efficiency is to be determined shall be fitted with a burner of corresponding designation. Prior to the test, the stove shall be checked and examined to ensure that all components are undamaged and properly assembled according to the manufacturer's instruction. The stove shall be lighted and allowed to burn for a period of 10 minutes at a working pressure of 100 kN/m^2 to 200 kN/m^2 (1 kgf/cm^2 to 2 kgf/cm^2) during which a blue flame shall be obtained. Now a vessel containing water shall be placed on the stove and the pressure shall be readjusted to get a maximum blue and stable flame.

In the manner prescribed above, the stove shall be operated at the maximum blue flame, height for two periods of approximately two hours each during which it shall be observed for any abnormal performance or leakage.

(This test should be done in draught-free room)

C-3 METHOD OF TEST

C-3.1 Fuel Consumption Test

The stove, whose efficiency is to be determined shall be filled with kerosene up to three-fourths of its capacity. The stove shall be lighted and brought up to working pressure of 140 kN/m^2 (1.4 kgf/cm^2) within five minutes.

After burning for 5 minutes, the lighted stove shall be weighed on a sensitive balance with an accuracy of one gram. The stove allowed to burn for one hour with an aluminium pan having sufficient water in it. At the end of one hour, weight of the burning stove shall be noted after removing the aluminium pan. The difference in the initial and final weight of the burning stoves shall give the kerosene consumption rate in grams per hour. A suitable pan for corresponding fuel consumption rate for the stove under test shall be selected in accordance with Table 1.

C-3.2 A cylindrical flat-bottomed aluminium pan (selected according to fuel consumption rate as given in Table 1) provided with an aluminium lid shall be used for this purpose. The lid shall have two holes, one for inserting the cork for holding a thermometer and the other for the stirrer (made of aluminium wire) required for stirring the water.

C-3.3 The pan first and then filled with the required amount of water (as given in Table 1) and initial temperature of water shall be kept within ± 2°C from the actual room temperature. The fuel container of the stove shall be connected to a pressure gauge and the fuel container filled to nearly three-fourths of the capacity. The stove shall be lighted at an average working pressure of 140 kN/m^2 (1.4 kgf/cm^2) and shall be maintained. After burning the stove for 5 minutes, weight of the stove, time and initial temperature of the water in the pan shall be noted. The pan shall be covered with a lid fitted with a test quality mercury thermometer inserted into the cork in such a way that the bulb of the thermometer immersed to half the depth of the water in the vessel. The thermometer shall be mercury-in-glass thermometer of accuracy 0.5°C. The free end of the stirrer shall come out of the lid.

C-3.4 The pan shall be placed on the stove after the initial weighing of the stove and the stop-watch shall be started immediately. As soon as the temperature of the water reaches 90 ± 1°C the stop-watch shall be stopped. The stove shall be weighed again after one hour of its previous weighing.

NOTE — Care should be taken to see that the same average working pressure is maintained throughout the test and the water stirred gently during heating.

C-3.5 In case hourly fuel consumption obtained during the test as per **C-3.4** falls above the highest or below the lowest limit of the range of kerosene consumption rate, on the basis of which the pan was selected earlier, then the test should be repeated with a pan based upon

Table 1 Aluminium Vessels for Thermal Efficiency Test

(*Clauses* **C-3.1**, **C-3.2**, **C-3.3** *and* **7.8**)

Sl No.	Consumption Rte g/h at Thermal Efficiency Test Pressure	Pan Diameter (External) Mm ± 5%	Pan Height (External) Mm ± 5%	Total Pan Mass with Lid g ± 10%	Mass of Water in Pan kg
(1)	(2)	(3)	(4)	(5)	(6)
(i)	151 – 180	245	130	632	4.8
(ii)	181 – 200	260	140	750	6.1
(iii)	201 – 240	285	155	853	7.7
(iv)	241 – 270	295	165	920	9.4
(v)	271 – 300	320	175	1100	11.4
(vi)	301 – 330	340	185	1200	12.5
(vii)	331 – 360	350	195	1310	14.0
(viii)	361 – 390	370	200	1420	16.0
(ix)	391 – 420	380	210	1530	18.0
(x)	421 – 450	400	215	1640	20.0
(xi)	451 – 480	410	225	1750	22.0
(xii)	481 – 510	420	230	1860	24.0
(xiii)	511 – 540	435	240	2000	26.5
(xiv)	541 – 570	450	245	2130	29.0
(xv)	571 – 600	460	250	2240	31.0
(xvi)	601 – 630	470	255	2320	33.0
(xvii)	631 – 660	780	260	2440	35.0
(xviii)	661 – 700	490	265	2520	38.0
(xix)	701 – 750	500	270	2650	41.0
(xx)	751 – 800	510	275	2720	44.0
(xxi)	801 – 850	530	280	3050	47.0
(xxii)	851 – 900	540	285	3190	50.0
(xxiii)	901 – 950	550	290	3330	53.0
(xxiv)	951 – 1000	560	300	3480	57.0

NOTE — For fuel consumption rate above 700 g/h, the upper limit of tolerance on the total weight with lid of the pan (col 4) may be increased to 30 percent.

$$\frac{\text{heat utlized}}{\text{heat produced}} \times 100$$

fuel consumption obtained during test as specified in **C-3.4**. The average of both calculations would give thermal efficiency of the stove.

NOTE — For fuel consumption rate above 700 g/h, the upper limit of tolerance on the total weight with lid of the pan (col 4) may be increased to 30 percent.

C-4 CALCULATION

C-4.1 Thermal efficiency of the stove shall be calculated as follows:

a) Heat gained by vessel = $M \times 0.214\ (t_2 - t_1)$ kcal

b) Heat utilized for heating water = $m \times 1\ (t_2 - t_1)$ kcal

c) Total heat utilized = $M \times (0.214 + m)\ (t_2 - t_1)$ kcal

d) Heat produced by fuel = $\frac{W \times T \times 10\,500}{60}$ kcal

e) Thermal efficiency =

$$= \frac{M \times (0.214 + m)\,(t_2 - t_1) \times 60 \times 100}{W \times T \times 10\,500}$$

where

M = mass in kg of the vessel complete with lid and stirrer,

t_1 = initial temperature of water in °C;

t_2 = final temperature of water in °C;

W = mass in kilogram of fuel consumed in one hour; and

T = time in minutes taken to heat the water to 90 ± 1°C, and

m = mass in kg of water in the pan.

NOTE — (Specific heat of aluminium is 0.214. Net calorific value of kerosene is 10 500 kcal/kg.)

ANNEX D

(*Clause* **9.4**)

METHOD OF MEASUREMENT OF SURFACE TEMPERATURE AND FUEL TEMPERATURE

D-1 PREPARATION OF STOVE

D-1.1 The stove shall be tested with the fuel container containing approximately 75 percent of the amount of fuel, which it would hold when full. The stove shall be lit and run at the full output (at a working pressure of 140 kN/m^2 to 200 kN/m^2) for one hour before starting the measurement of temperature, with the vessel containing water placed over it.

D-2 PROCEDURE

D-2.1 The temperature of all parts of the stove which may be necessary to touch during its operation shall be measured by using a mercury bulb thermometer. The temperature of each such part shall be measured thrice every 30 minutes to get three concordant readings. While measuring the temperature, the thermometer shall be covered with a felt pad and kept in contact with that part for sufficient period of time until maximum temperature is reached.

D-2.2 During the operation of the stove under **D-2.1**, the maximum temperature of fuel in the container shall also be recorded. The final reading shall be taken at the end of three hours running operation.

ANNEX E

(*Clause* **9.5**)

TEST FOR COMBUSTION EFFICIENCY

E-1 EQUIPMENT

E-1.1 The stove shall be tested with its fuel container filled with kerosene to nearly three-fourths of its capacity. Before starting the test, a pan of the type and size as described in **C-3.1** and containing water sufficient for the test shall be placed over the burner. In addition, a collecting hood (*see* Fig. 3) suitable for stove under examination shall be used.

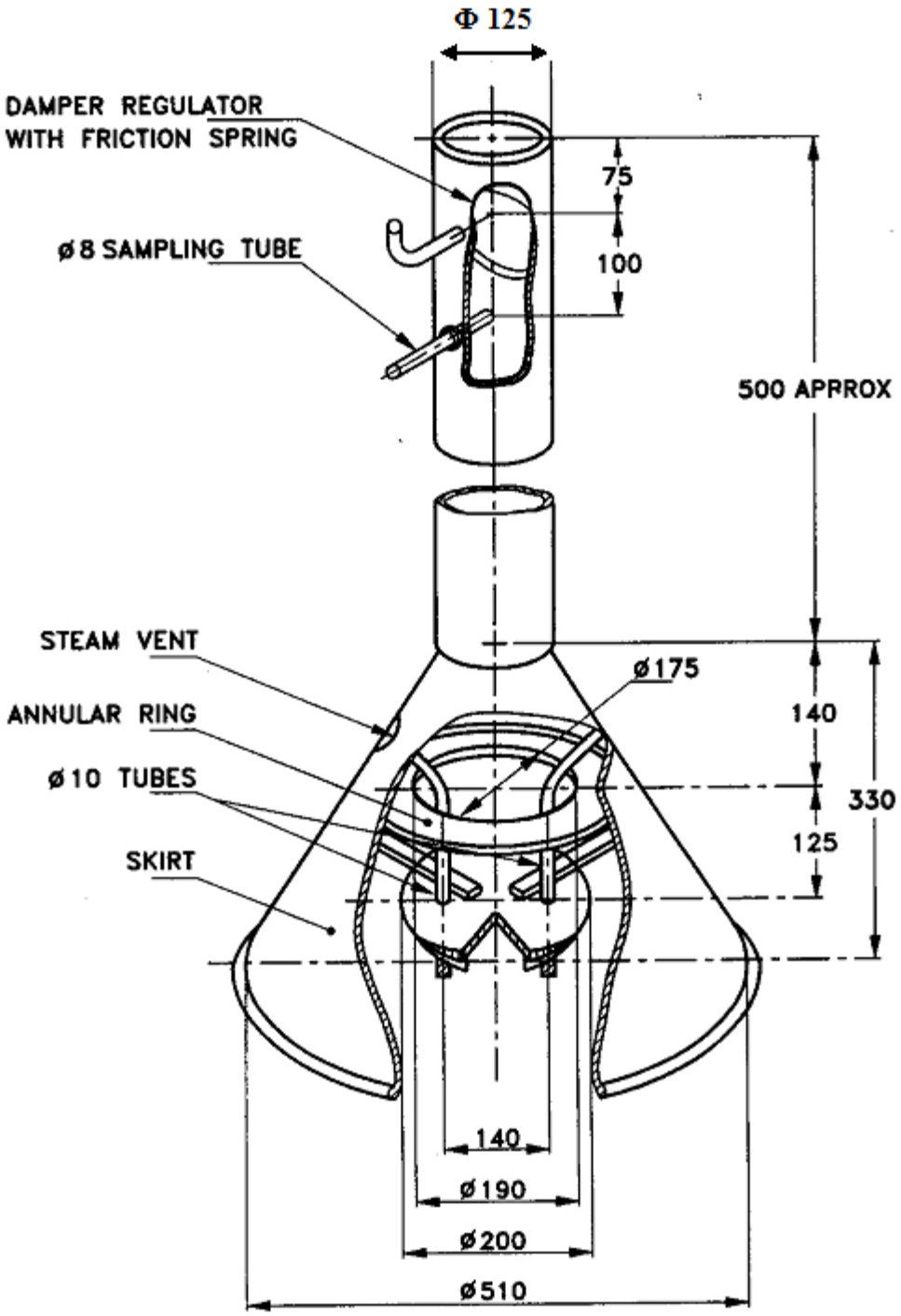
E-1.1.1 The hood shall be so designed that, while not interfering in any way with the normal combustion of the burner it collects a fairly high proportion of the flue gases. Also it shall be such that the sample collected represents the whole of combustion gases and not those from one particular point. When using hood, the damper provided shall be set, or an additional flue pipe added, so that spillage of the flue gases around the skirt is minimized.

E-2 PROCEDURE

E-2.1 With the hood in position over the stove under investigation, the stove shall be lit and run at full output for a few minutes till a stable flame is achieved. Then a sufficient-number of samples shall be collected.

E-2.2 The flue gas shall be analyzed by using any of the recognized methods. For carbon monoxide, it is recommended that Co-indicator of prescribed accuracy or iodine pentoxide method or catalytic method, for example, Drager method, the Katz method or infra-red analysis method may be used. Carbon dioxide may be tested by using Orsat apparatus, or Haldane apparatus, or by the infra-red analysis.

E-2.3 The carbon monoxide and carbon dioxide content of the product of combustion shall be determined by the methods capable of an accuracy of 0.001 percent and 0.5 percent, respectively of the volume of the sample.



NOTE — All dimensions specified are optional.

FIG. 3 HOOD FOR BURNER

ANNEX F

(*Clause* **10**)

SAMPLING SCHEME AND CRITERIA FOR CONFORMITY FOR OIL PRESSURE STOVES

F-1 LOT

F-1.1 In any consignment, all stoves of the same designation, type, fuel capacity and manufactured from the same materials under essentially similar conditions of production shall be grouped together to constitute a lot.

F-1.2 Each lot shall be inspected separately to ascertain its conformity or otherwise to the requirements of this specification.

F-2 SELECTION OF SAMPLES

F-2.1 The number of samples to be selected at random from a lot shall depend upon the size of the lot and shall be in accordance with col 1 and 2 of Table 2.

F-2.2 The stoves to be selected from the lot shall be chosen at random and in order to ensure the randomness of selection IS 4905 shall be followed.

F-3 NUMBER OF TESTS AND CRITERIA FOR CONFORMITY

F-3.1 Inspection for Shape, Dimensions, Construction and Finish

All the stoves selected according to **F-2.1** and col 2 of Table 2 shall be first inspected for shape, dimensions, construction and finish. Any stove failing in one or more of the above characteristics shall be considered as defective. The lot shall be considered as conforming to the requirements of these characteristics, if the number of defective stoves in the sample does not exceed the permissible number of defectives given in col 3 of Table 2.

F-3.2 Testing for Internal Air Pressure

The stoves in the sample having passed the requirements of **F-3.1** shall be subjected to internal air pressure test in accordance with **9.1.1**. The lot shall be considered as conforming to the requirements of internal air pressure test if none of the sample stoves fails in the test.

F-3.3 Testing for Safety Pressure and Bursting Pressure

From the stoves inspected/tested under **F-3.1** and **F-3.2** and found conforming to the requirements of above mentioned characteristics, a sub-sample of the size given in col 4 of Table 2 shall be selected at random and subjected to safety pressure test and subsequently to bursting pressure test in accordance with **9.1.2** and **9.1.3**. A stove failing to satisfy either safety pressure test or bursting pressure test or both, shall be considered as defective. The lot shall be declared as conforming to the requirements of safety pressure and bursting pressure if the number of defective stoves as obtained above does not exceed the permissible number of defectives given in col 5 of Table 2.

F-3.3.1 For lots of sizes less than 1 000 stoves, if one of the stoves in the sub-sample is found failing for bursting pressure test, a further sub-sample of the same size as indicated in col 4 of Table 2 may be selected from the stoves inspected/tested under **F-3.1** and **F-3.2** and found conforming to the relevant requirements. The stoves in this sub-sample may be subjected to bursting pressure test. The lot shall be declared as conforming to the requirements of bursting pressure test, if none of the stoves in the second sub-sample is found failing.

F-3.4 From the sample stoves inspected/tested under **F-3.1** and **F-3.2**, five stoves for lot sizes up to 500, ten stoves for lot sizes 501 to 3 000, and fifteen stoves for lot sizes above 3 000 shall be selected at random and subjected to thermal efficiency, surface temperature and fuel temperature test. The lot shall be considered as conforming to the requirements of these two tests only if all the above tested stoves pass the requirements of these tests.

Table 2 Sample Size and Criteria for Conformity
(*Clauses* **F-2.1**, **F-3.1**, **F-3.3** *and* **F-3.3.1**)

Sl No.	No. of Stoves in the Lot	No. of Stoves to be Selected in the Sample	Permissible No. of Defective Stoves	Sub-Sample Size	Permissible No. of Defective in the Sub-Sample
(1)	(2)	(3)	(4)	(5)	(6)
(i)	Up to 150	20	0	5	0
(ii)	151 to 300	32	1	8	0
(iii)	301 to 500	50	2	13	0
(iv)	501 to 1 000	80	3	20	0
(v)	1 001 to 3 000	125	5	32	1
(vi)	3 001 and above	200	7	50	2

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